CLAIMS

1. A method for controlling microbial or biofilm growth in a medium, the method comprising mixing a salt of the formula $Y^{x-}[NH_2R^3R^4]^+_x$, or a mixture of such salts, and an aqueous solution of a hypochlorite oxidant to form a biocide,

wherein

Y^{x-} is a basic form of an acid Y that contains at least one moiety selected from the group consisting of a primary amine moiety, a secondary amine moiety, a tertiary amine moiety, an amide moiety, an imide moiety, a sulfamide moiety, a sulfimide moiety, and an amineimine moiety; and

$[NH_2R^3R^4]^+$ is an acidic form of a base NHR^3R^4 wherein:

R^3 and R^4 are each independently selected from the group consisting of H and C_{1-8} alkyl,

or R^3 and R^4, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl; and

x is 1 to 3;

and the molar ratio of $[NH_2R^3R^4]^+$ to hypochlorite is at least 1:1,

and applying said biocide to said medium.

2. A method according to claim 1, wherein Y is selected from the group consisting of straight, branched and cyclic molecules containing at least one moiety selected from the group consisting of an amide moiety, an imide moiety, a sulfamide moiety, a sulfimide moiety, and an amineimine moiety, and Y^{x-} is a basic form of said molecule.

3. A method according to claim 1, wherein Y is selected from the group consisting of amphoteric molecules containing at least one moiety selected from the group consisting of a primary amine moiety, a secondary amine moiety, and a tertiary amine moiety, and at least one moiety selected from the group consisting of COOH and SO_3H, and Y^{x-} is an anionic form of said amphoteric molecule.

4. A method according to claim 3, wherein Y^{x-} is of the formula $[R^1R^2N\text{-}A\text{-}COO]^{x-}$ or $[R^1R^2N\text{-}A\text{-}SO_3]^{x-}$, wherein:

A is a bond, straight-chain or branched $C_{1\text{-}20}$ alkyl, straight-chain or branched $C_{2\text{-}20}$ alkenyl, straight-chain or branched $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, straight-chain or branched $C_4\text{-}C_{20}$ alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl, or $C_6\text{-}C_{10}$ aryl, wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, $C_4\text{-}C_{20}$ alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or $C_6\text{-}C_{10}$ aryl is optionally substituted with one or more groups selected from -COOH, -COH, $-SCH_3$, $-NH_2$, =NH, $-NHC(=NH)NH_2$, $-C(=O)NH_2$, -OH, 4-hydroxyphenyl, 5-imidazolyl, 3-indolyl, halogen, $-SO_3H$, =O, $C_{1\text{-}8}$ alkyl, $C_{3\text{-}8}$ cycloalkyl, $C_{4\text{-}9}$ cycloalkylalkyl, phenyl, 4-methylphenyl, benzyl, $-O\text{-}C_{3\text{-}8}$ cyclalkyl, $-O\text{-}C_{3\text{-}8}$ cycloalkyl, $-O\text{-}C_{4\text{-}9}$ cycloalkylalkyl, -O-phenyl, -O-4-methylphenyl, -O-benzyl, $-SO_2R^7$ or $-NHR^7$ wherein R^7 is H, $C_{1\text{-}8}$ alkyl, phenyl, 4-methylphenyl, benzyl or $-NH_2$, and wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, $C_4\text{-}C_{20}$ alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or $C_6\text{-}C_{10}$ aryl optionally contains one to three heteroatoms selected from N, O and S;

R^1 and R^2 are each independently selected from the group consisting of H, straight-chain or branched $C_{1\text{-}20}$ alkyl, straight-chain or branched $C_{2\text{-}20}$ alkenyl, straight-chain or branched $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, straight-chain or branched $C_4\text{-}C_{20}$ alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl, or $C_6\text{-}C_{10}$ aryl, wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, $C_4\text{-}C_{20}$ alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or $C_6\text{-}C_{10}$ aryl is optionally substituted with one or more groups selected from -COOH, -COH, $-SCH_3$, $-NH_2$, =NH, $-NHC(=NH)NH_2$, $-C(=O)NH_2$, -OH, 4-hydroxyphenyl, 5-imidazolyl, 3-indolyl, halogen, $-SO_3H$, =O, $C_{1\text{-}8}$ alkyl, $C_{3\text{-}8}$ cycloalkyl, $C_{4\text{-}9}$ cycloalkylalkyl, phenyl, 4-methylphenyl, benzyl, $-O\text{-}C_{3\text{-}8}$ cyclalkyl, $-O\text{-}C_{3\text{-}8}$ cycloalkyl, $-O\text{-}C_{4\text{-}9}$ cycloalkylalkyl, -O-phenyl, -O-4-methylphenyl, -O-benzyl, $-SO_2R^7$ or $-NHR^7$ wherein R^7 is H, $C_{1\text{-}8}$ alkyl, phenyl, 4-methylphenyl, benzyl or $-NH_2$, and wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, $C_4\text{-}C_{20}$ alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or $C_6\text{-}C_{10}$ aryl optionally contains one to three heteroatoms selected from N, O and S;

or R^1 and A, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring or a 5- to 10-member heteroaromatic ring in which the free electron pair of the nitrogen atom to which R^1 and A is attached is not part of the aromatic pi-electron system, the 5- to 10-member heterocyclic or heteroaromatic ring being optionally substituted by one or more groups selected from $C_{1\text{-}6}$ alkyl, $C_{3\text{-}8}$ cycloalkyl, halogen, hydroxy, $-OC_{1\text{-}6}$ alkyl or $-OC_{3\text{-}8}$ cycloalkyl;

or R^1 and R^2, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring or a 5- to 10-member heteroaromatic ring in which the free electron pair of the

nitrogen atom to which R^1 and A is attached is not part of the aromatic pi-electron system, the 5- to 10-member heterocyclic or heteroaromatic ring being optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl.

5. A method according to any one of claims 1-4, wherein the concentration of said hypochlorite oxidant in said aqueous hypochlorite oxidant solution immediately prior to mixing with said salt or mixture of salts is not more than 24,000 ppm as total chlorine.

6. A method according to claim 5, wherein the concentration of said hypochlorite oxidant in said aqueous hypochlorite oxidant solution immediately prior to mixing with said salt or mixture of salts is not more than 12,000 ppm as total chlorine.

7. A method according to any one of claims 1-6, wherein said salt or mixture of salts is in an aqueous solution at a concentration of 0.5-60% w/v immediately prior to mixing with said hypochlorite oxidant solution.

8. A method according to any one of claims 1-7, wherein said mixing takes place in a mixing chamber into and out of which there is a continuous flow of water during said mixing.

9. A method according to claim 8, wherein said biocide is applied to said medium substantially as said biocide is formed.

10. A method according to claim 8, wherein said biocide is applied to said medium within 30 seconds of formation of said biocide.

11. A method according to claim 8, wherein said biocide is applied to said medium within 60 seconds of formation of said biocide.

12. A method according to claim 8, wherein said biocide is applied to said medium within 90 seconds of formation of said biocide.

13. A method according to claim 8, wherein said biocide is applied to said medium within 120 seconds of formation of said biocide.

14. A method according to claim 8, wherein said biocide is applied to said medium within 150 seconds of formation of said biocide.

15. A method according to claim 8, wherein said biocide is applied to said medium within 180 seconds of formation of said biocide.

16. A method according to any one of claims 8-14, wherein said mixing chamber is a conduit.

17. A method according to any one of claims 1-7, wherein said mixing takes place in a mixing chamber out of which there is not a continuous flow of water during said mixing.

18. A method according to claim 17, wherein said biocide is applied to said medium substantially immediately upon completion of said mixing.

19. A method according to claim 17, wherein said biocide is applied to said medium within 30 seconds of completion of said mixing.

20. A method according to claim 17, wherein said biocide is applied to said medium within 60 seconds of completion of said mixing.

21. A method according to claim 17, wherein said biocide is applied to said medium within 90 seconds of completion of said mixing.

22. A method according to claim 17, wherein said biocide is applied to said medium within 120 seconds of completion of said mixing.

23. A method according to claim 17, wherein said biocide is applied to said medium within 150 seconds of completion of said mixing.

24. A method according to claim 17, wherein said biocide is applied to said medium within 180 seconds of completion of said mixing.

25. A method according to any one of claims 1-24 wherein said hypochlorite oxidant is selected from the group consisting of alkaline and alkali earth metal hypochlorites, hypochlorite released to water from a stable chlorine carrier and hypochlorite formed *in situ* from chlorine gas, and mixtures thereof.

26. A method according to claim 25, wherein said stable chlorine carrier is selected from the group consisting of trichlorocyanuric acid, dichlorodimethylhydantoin and chlorodimethylhydantoin.

27. A method according to any one of claims 1-25, wherein said hypochlorite oxidant is selected from the group consisting of lithium hypochlorite, sodium hypochlorite, calcium hypochlorite, magnesium hypochlorite and potassium hypochlorite.

28. A method according to any one of claims 1-27, wherein said hypochlorite oxidant is sodium hypochlorite.

29. A method according to any one of claims 1-28, wherein R^3 and R^4 are H.

30. A method according to any one of claims 1-28, wherein one of R^3 and R^4 is H and the other is not.

31. A method according to any one of claims 1-28, wherein neither R^3 nor R^4 is H.

32. A method according to any one of claims 1-31, wherein Y is selected from the group consisting of carbamic acid, sulfamic acid, glycine, glutamine, arginine, histidine, and lysine, and mixtures thereof.

33. A method according to any one of claims 1 and 5-31, wherein Y is selected from the group consisting of melamine, cyanuric acid, hydantoin, dialkyl hydantoin, biuret, succinamide, succinimide, creatine, and creatinine, and mixtures thereof.

34. A method according to any one of claims 1-33, wherein the molar ratio of $[NH_2R^3R^4]^+$ to hypochlorite oxidant is 1:1.

35. A method according to any one of claims 1-33, wherein the molar ratio of $[NH_2R^3R^4]^+$ to hypochlorite oxidant is greater than 1:1

36. A method according to claim 8, wherein the concentration of said hypochlorite oxidant in said aqueous hypochlorite oxidant solution immediately prior to mixing with said salt or mixture of salts is not more than 24,000 ppm as total chlorine, and wherein said mixing chamber comprises a conduit through which water flows as said hypochlorite oxidant solution and said salt are mixed.

37. A method according to claim 36, wherein the concentration of said hypochlorite oxidant in said aqueous hypochlorite oxidant solution immediately prior to mixing with said salt or mixture of salts is not more than 12,000 ppm as total chlorine.

38. A method according to claim 36 or 37, wherein said solution of hypochlorite oxidant is prepared *in situ* in said conduit prior to addition of said salt or mixture of salts to said conduit.

39. A method according to any one of claims 1-38, wherein said salt or mixture of salts is diluted prior to mixing with said hypochlorite oxidant.

40. A method according to any one of claims 1-39, wherein said biocide has a pH of between 8.0 and 11.5 immediately prior to being applied to the medium.

41. A method according to claim 40, wherein said biocide has a pH of at least 8.5 immediately prior to being applied to the medium.

42. A method according to claim 40, wherein said biocide has a pH of at least 9.0 immediately prior to being applied to the medium.

43. A method according to claim 40, wherein said biocide has a pH of at least 9.5 immediately prior to being applied to the medium.

44. A method according to claim 40, wherein said biocide has a pH of at least 10.0 immediately prior to being applied to the medium.

45. A method according to claim 40,wherein said biocide has a pH of at least 10.5 immediately prior to being applied to the medium.

46. A method according to claim 40,wherein said biocide has a pH of at least 11.0 immediately prior to being applied to the medium.

47. A method according to any one of claims 1-46, wherein said biocide has a pH of no more than 11.5 immediately prior to being applied to the medium.

48. A method according to any one of claims 1-47, wherein said medium is selected from the group consisting of pulp and paper factory process water, cooling tower water, waste water, reclaimed waste water, clay slurries, starch slurries, sludge, soil, colloidal suspensions, irrigation water, and liquids having a high reducing capacity.

49. A method according to any one of claims 1-47, wherein said medium is pulp and paper factory process water.

50. A method according to any one of claims 1-47, wherein said medium is cooling tower water.

51. A method according to any one of claims 1-47, wherein said medium is waste water.

52. A method according to any one of claims 1-47, wherein said medium is reclaimed waste water.

53. A method according to any one of claims 1-47, wherein said medium is a clay slurry.

54. A method according to any one of claims 1-47, wherein said medium is a starch slurry.

55. A method according to any one of claims 1-47, wherein said medium is a sludge.

56. A method according to any one of claims 1-47, wherein said medium is soil.

57. A method according to any one of claims 1-47, wherein said medium is a colloidal suspension.

58. A method according to any one of claims 1-47, wherein said medium is irrigation water.

59. A method according to any one of claims 1-48, wherein said medium is a medium having a high reducing capacity.

60. A method according to claim 1, wherein said medium has an ORP of not greater than 150 millivolts.

61. A method according to any one of claims 1-59, wherein said hypochlorite oxidant and said salt or mixture of salts are mixed in the absence of added bromide and said medium is substantially free of added bromide during application of said biocide.

62. A method according to claim 61, wherein bromide is not added to said medium as a as a component to supplement or enhance said biocide.

63. A method according to any one of claims 1 to 62, wherein said biocide is applied to said medium periodically with a duty cycle of less than 1:2.

64. A method according to any one of claims 1 to 62, wherein said biocide is applied to said medium periodically with a duty cycle of between about 1:5 and 1:10.

65. A method according to any one of claims 1 to 62, wherein said biocide is applied to said medium periodically with a duty cycle of less than 1:10.

66. A method according to any one of claims 1 to 62, wherein said biocide is applied to said medium periodically with a duty cycle of less than 1:25.

67. A method according to any one of claims 1 to 62, wherein said biocide is applied to said medium periodically with a duty cycle of less than 1:50.

68. A method according to any one of claims 1-67, wherein said biocide is applied to said medium at a rate to maintain in the biocide a stable pH of at least 8.0 as said biocide is produced.

69. A method according to any one of claims 1-68 wherein the concentration of the biocide immediately prior to being applied to said medium is from 1000 to 12000 ppm expressed as total chlorine.

70. A method according to any one of claims 1-69 wherein said medium has a pH of between about 5 and about 11.5 before said biocide is applied to said medium.

71. A method according to claim 71, wherein said medium has a pH of between about 6 and about 10 before said biocide is applied to said medium.

72. A method according to claim 71, wherein said medium has a pH of between about 7 and about 9 before said biocide is applied to said medium.

73. A method according to any one of claims 8 to 24, wherein the concentration of said biocide in said medium, upon application of said biocide to said medium, is 0.5-300 ppm expressed as chlorine.

74. A method according to any one of claims 8 to 24, wherein the concentration of said biocide in said medium, upon application of said biocide to said medium, is 1-10 ppm expressed as chlorine.

75. A method according to any one of claims 1-74, wherein the biocide is effective within 1 hour of application to said medium.

76. A method according to claim 75, wherein the biocide is effective within 15 minutes of application to said medium.

77. Apparatus for applying a biocide to a medium, comprising:

a salt-containing reservoir containing a salt of the formula $Y^{x-}[NH_2R^3R^4]^+_x$, or a mixture of such salts, wherein

Y^{x-} is a basic form of an acid Y that contains at least one moiety selected from the group consisting of a primary amine moiety, a secondary amine moiety, a tertiary amine moiety, an amide moiety, an imide moiety, a sulfamide moiety, a sulfimide moiety, and an amineimine moiety;

$[NH_2R^3R^4]^+$ is an acidic form of a base NHR^3R^4 wherein:

R^3 and R^4 are each independently selected from the group consisting of H and C_{1-8} alkyl, or

R^3 and R^4, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl; and

x is 1 to 3;

a source of hypochlorite oxidant dilution having a concentration of not more than 24,000 ppm as total chlorine,

and a mixing chamber operable to mix said dilution and said salt or mixture of salts in a molar ratio of $[NH_2R^3R^4]^+$ to hypochlorite of at least 1:1, to produce said biocide in said mixing chamber.

78. Apparatus according to claim 77, wherein said source of hypochlorite oxidant dilution has a concentration of not more than 12,000 ppm as total chlorine.

79. Apparatus according to claim 77, wherein Y is selected from the group consisting of straight, branched and cyclic molecules containing at least one moiety selected from the group consisting of an amide moiety, an imide moiety, a sulfamide moiety, a sulfimide moiety, and an amineimine moiety, and Y^{x-} is basic form of said molecule.

80. Apparatus according to claim 77, wherein Y is selected from the group consisting of amphoteric molecules containing at least one moiety selected from the group consisting of a primary amine moiety, a secondary amine moiety, and a tertiary amine moiety, and at least one moiety selected from the group consisting of COOH and SO_3H, and Y^{x-} is an anionic form of said amphoteric molecule.

81. An apparatus according to claim 77, wherein said salt or mixture of salts is present in said salt-containing reservoir as an aqueous solution.

82. An apparatus according to claim 77 or 81, wherein said source of hypochlorite oxidant dilution comprises

a hypochlorite-containing reservoir containing a hypochlorite oxidant solution, and

a diluter operable to dilute said hypochlorite oxidant solution to produce said hypochlorite oxidant dilution having a concentration of not more than 24,000 ppm as total chlorine.

83. Apparatus according to claim 82, wherein said diluter is operable to dilute said hypochlorite oxidant solution to produce said hypochlorite oxidant dilution having a concentration of not more than 12,000 ppm as total chlorine.

84. An apparatus according to any one of claims 77-82, further comprising an egress adapted to enable application of said biocide from said mixing chamber to said medium.

85. An apparatus according to claim 82, wherein said diluter and said mixing chamber are a single conduit which is adapted to dilute said hypochlorite oxidant prior to mixing with said salt or mixture of salts.

86. A salt of the formula $Y^{x-}[NHR^3R^4Cl]^+_x$, wherein

Y^{x-} is a basic form of an acid Y that contains at least one moiety selected from the group consisting of a primary amine moiety, a secondary amine moiety, a tertiary amine moiety, an amide moiety, an imide moiety, a sulfamide moiety, a sulfimide moiety, and an amineimine moiety; and

$[NHR^3R^4Cl]^+$ is an acidic form of a base NHR^3R^4 wherein:

R^3 and R^4 are each independently selected from the group consisting of H and C_{1-8} alkyl,

or R^3 and R^4, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl; and

x is 1 to 3.

87. A salt according to claim 86, wherein Y is selected from the group consisting of straight, branched and cyclic molecules containing at least one moiety selected from the group consisting

of an amide moiety, an imide moiety, a sulfamide moiety, a sulfimide moiety, and an amineimine moiety, and Y^{x-} is basic form of said molecule.

88. A salt according to claim 86, wherein Y is selected from the group consisting of amphoteric molecules containing at least one moiety selected from the group consisting of a primary amine moiety, a secondary amine moiety, and a tertiary amine moiety, and at least one moiety selected from the group consisting of COOH and SO_3H, and Y^{x-} is an anionic form of said amphoteric molecule.

89. A salt according to claim 88, wherein Y^{x-} is of the formula $[R^1R^2N\text{-}A\text{-}COO]^{x-}$ or $[R^1R^2N\text{-}A\text{-}SO_3]^{x-}$, wherein:

A is a bond, straight-chain or branched $C_{1\text{-}20}$ alkyl, straight-chain or branched $C_{2\text{-}20}$ alkenyl, straight-chain or branched $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, straight-chain or branched C_4-C_{20} alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl, or C_6-C_{10} aryl, wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, C_4-C_{20} alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or C_6-C_{10} aryl is optionally substituted with one or more groups selected from -COOH, -COH, $-SCH_3$, $-NH_2$, =NH, $-NHC(=NH)NH_2$, $-C(=O)NH_2$, -OH, 4-hydroxyphenyl, 5-imidazolyl, 3-indolyl, halogen, $-SO_3H$, =O, $C_{1\text{-}8}$ alkyl, $C_{3\text{-}8}$ cycloalkyl, $C_{4\text{-}9}$ cycloalkylalkyl, phenyl, 4-methylphenyl, benzyl, -O-$C_{3\text{-}8}$ cyclalkyl, -O-$C_{3\text{-}8}$ cycloalkyl, -O-$C_{4\text{-}9}$ cycloalkylalkyl, -O-phenyl, -O-4-methylphenyl, -O-benzyl, $-SO_2R^7$ or $-NHR^7$ wherein R^7 is H, $C_{1\text{-}8}$ alkyl, phenyl, 4-methylphenyl, benzyl or $-NH_2$, and wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, C_4-C_{20} alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or C_6-C_{10} aryl optionally contains one to three heteroatoms selected from N, O and S;

R^1 and R^2 are each independently selected from the group consisting of H, straight-chain or branched $C_{1\text{-}20}$ alkyl, straight-chain or branched $C_{2\text{-}20}$ alkenyl, straight-chain or branched $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, straight-chain or branched C_4-C_{20} alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl, or C_6-C_{10} aryl, wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, C_4-C_{20} alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or C_6-C_{10} aryl is optionally substituted with one or more groups selected from -COOH, -COH, $-SCH_3$, $-NH_2$, =NH, $-NHC(=NH)NH_2$, $-C(=O)NH_2$, -OH, 4-hydroxyphenyl, 5-imidazolyl, 3-indolyl, halogen, $-SO_3H$, =O, $C_{1\text{-}8}$ alkyl, $C_{3\text{-}8}$ cycloalkyl, $C_{4\text{-}9}$ cycloalkylalkyl, phenyl, 4-methylphenyl, benzyl, -O-$C_{3\text{-}8}$ cyclalkyl, -O-$C_{3\text{-}8}$ cycloalkyl, -O-$C_{4\text{-}9}$ cycloalkylalkyl, -O-phenyl, -O-4-methylphenyl, -O-benzyl, $-SO_2R^7$ or $-NHR^7$ wherein R^7 is H, $C_{1\text{-}8}$ alkyl, phenyl, 4-methylphenyl, benzyl or $-NH_2$, and wherein each $C_{1\text{-}20}$ alkyl, $C_{2\text{-}20}$ alkenyl, $C_{2\text{-}20}$ alkynyl, $C_{3\text{-}10}$ cycloalkyl, C_4-C_{20} alkylcycloalkyl, $C_{4\text{-}10}$ cycloalkenyl, $C_{4\text{-}10}$ cycloalkynyl or C_6-C_{10} aryl optionally contains one to three heteroatoms selected from N, O and S;

or R^1 and A, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring or a 5- to 10-member heteroaromatic ring in which the free electron pair of the nitrogen atom to which R^1 and A is attached is not part of the aromatic pi-electron system, the 5- to 10-member heterocyclic or heteroaromatic ring being optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl;

or R^1 and R^2, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring or a 5- to 10-member heteroaromatic ring in which the free electron pair of the nitrogen atom to which R^1 and A is attached is not part of the aromatic pi-electron system, the 5- to 10-member heterocyclic or heteroaromatic ring being optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl.

90. A salt according to any one of claims 86-89, wherein Y is selected from the group consisting of carbamic acid, sulfamic acid, glycine, glutamine, arginine, histidine, and lysine.

91. A salt according to claim 86 or 87, wherein Y is selected from the group consisting of melamine, cyanuric acid, hydantoin, dialkyl hydantoin, biuret, succinamide, succinimide, creatine, and creatinine.

92. A compound selected from the group consisting of:

compounds of the formulae $[R^1R^2NCl\text{-}A\text{-}COO]$ and $[R^1R^2NCl\text{-}A\text{-}SO_3]$ and tautomers thereof, wherein:

A is a bond, straight-chain or branched C_{1-20} alkyl, straight-chain or branched C_{2-20} alkenyl, straight-chain or branched C_{2-20} alkynyl, C_{3-10} cycloalkyl, straight-chain or branched C_4-C_{20} alkylcycloalkyl, C_{4-10} cycloalkenyl, C_{4-10} cycloalkynyl, or C_6-C_{10} aryl, wherein each C_{1-20} alkyl, C_{2-20} alkenyl, C_{2-20} alkynyl, C_{3-10} cycloalkyl, C_4-C_{20} alkylcycloalkyl, C_{4-10} cycloalkenyl, C_{4-10} cycloalkynyl or C_6-C_{10} aryl is optionally substituted with one or more groups selected from -COOH, -COH, $-SCH_3$, $-NH_2$, =NH, $-NHC(=NH)NH_2$, $-C(=O)NH_2$, -OH, 4-hydroxyphenyl, 5-imidazolyl, 3-indolyl, halogen, $-SO_3H$, =O, C_{1-8} alkyl, C_{3-8} cycloalkyl, C_{4-9} cycloalkylalkyl, phenyl, 4-methylphenyl, benzyl, $-O\text{-}C_{3-8}$ cyclalkyl, $-O\text{-}C_{3-8}$ cycloalkyl, $-O\text{-}C_{4-9}$ cycloalkylalkyl, -O-phenyl, -O-4-methylphenyl, -O-benzyl, $-SO_2R^7$ or $-NHR^7$ wherein R^7 is H, C_{1-8} alkyl, phenyl, 4-methylphenyl, benzyl or $-NH_2$, and wherein each C_{1-20} alkyl, C_{2-20} alkenyl, C_{2-20} alkynyl, C_{3-10} cycloalkyl, C_4-C_{20} alkylcycloalkyl, C_{4-10} cycloalkenyl, C_{4-10} cycloalkynyl or C_6-C_{10} aryl optionally contains one to three heteroatoms selected from N, O and S;

R^1 and R^2 are each independently selected from the group consisting of H, straight-chain or branched C_{1-20} alkyl, straight-chain or branched C_{2-20} alkenyl, straight-chain or branched C_{2-20} alkynyl, C_{3-10} cycloalkyl, straight-chain or branched C_4-C_{20} alkylcycloalkyl, C_{4-10} cycloalkenyl, C_{4-10} cycloalkynyl, or C_6-C_{10} aryl, wherein each C_{1-20} alkyl, C_{2-20} alkenyl, C_{2-20} alkynyl, C_{3-10} cycloalkyl, C_4-C_{20} alkylcycloalkyl, C_{4-10} cycloalkenyl, C_{4-10} cycloalkynyl or C_6-C_{10} aryl is optionally substituted with one or more groups selected from -COOH, -COH, $-SCH_3$, $-NH_2$, =NH, $-NHC(=NH)NH_2$, $-C(=O)NH_2$, -OH, 4-hydroxyphenyl, 5-imidazolyl, 3-indolyl, halogen, $-SO_3H$, =O, C_{1-8} alkyl, C_{3-8} cycloalkyl, C_{4-9} cycloalkylalkyl, phenyl, 4-methylphenyl, benzyl, $-O-C_{3-8}$ cyclalkyl, $-O-C_{3-8}$ cycloalkyl, $-O-C_{4-9}$ cycloalkylalkyl, -O-phenyl, -O-4-methylphenyl, -O-benzyl, $-SO_2R^7$ or $-NHR^7$ wherein R^7 is H, C_{1-8} alkyl, phenyl, 4-methylphenyl, benzyl or $-NH_2$, and wherein each C_{1-20} alkyl, C_{2-20} alkenyl, C_{2-20} alkynyl, C_{3-10} cycloalkyl, C_4-C_{20} alkylcycloalkyl, C_{4-10} cycloalkenyl, C_{4-10} cycloalkynyl or C_6-C_{10} aryl optionally contains one to three heteroatoms selected from N, O and S;

or R^1 and A, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring or a 5- to 10-member heteroaromatic ring in which the free electron pair of the nitrogen atom to which R^1 and A is attached is not part of the aromatic pi-electron system, the 5- to 10-member heterocyclic or heteroaromatic ring being optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl;

or R^1 and R^2, together with the nitrogen atom to which they are attached, form a 5- to 10-member heterocyclic ring or a 5- to 10-member heteroaromatic ring in which the free electron pair of the nitrogen atom to which R^1 and A is attached is not part of the aromatic pi-electron system, the 5- to 10-member heterocyclic or heteroaromatic ring being optionally substituted by one or more groups selected from C_{1-6} alkyl, C_{3-8} cycloalkyl, halogen, hydroxy, $-OC_{1-6}$ alkyl or $-OC_{3-8}$ cycloalkyl.

93. A molecular species which is an N-chlorocarbamate.

94. A molecular species which is an N-chlorosulfamate.